The network for best practices of river restoration in Greater Europe

ECRR
European Centre for River Restoration

ECRR Technical News • December 2024

Contents

Editorial

Flowing Forward: Collaborative Efforts to Restore Europe's Rivers

In this 'Technical News,' three standout articles highlight the transformative power of river restoration actions: the Gipuzkoa Masterplan, the European Open Rivers Programme, and the self-restoration of the Lower Dnipro region.

The **Gipuzkoa Masterplan** in Spain restores natural river flow by removing obstacles like weirs and dams, boosting water flow enhancing fish populations and ecological health.

The **Open Rivers Programme**, funded by Arcadia, is granting barrier removal projects supporting river flow and biodiversity restoration across Europe. They supported the removal of 119 barriers and aims the removal of 500 barriers restoring 5,000 km by 2029.

The destruction of the Kakhovka dam in Ukraine in June 2023, causing ecological devastation, initiates also the **Lower Dnipro Self-restoration**, an alternative option from the past with native vegetation and wildlife returning.

These developments show the opportunities and challenges of restoring river ecosystems. By removing barriers and enhancing connectivity, they enhance fish populations, promote biodiversity and improve conservation. Let's continue to support and celebrate these remarkable initiatives. A heartfelt thanks to all involved for their inspiring work!

On behalf of the ECRR Members and Board,
Bart Fokkens

Hydro-power plant RENTERIA at the Urumea River. Bart Fokkens / ECRR

Towards a Sustainable and Replicable Model for River Restoration and Species Conservation

Authors

Gipuzkoa connectivity masterplan 2020-2035 – A tool to make decisions

Arantxa Uzurrunzaga,
Department of Sustainability of Gipuzko County Council

and

LIFE project Kantauribai: Improving diadromous fish populations in Cantabrian Rivers

Josu Elso,
Environment Agency Navarra

Gipuzkoa Masterplan

In the north of Spain, the Basque and Cantabrian Mountains stretch for over 300 km across northern Spain, from the western limit of the Pyrenees to the Galician Massif in Galicia, along the coast of the Cantabrian Sea.

This region experiences a significant amount of 1,400 mm of precipitation throughout the year. This means that the rivers have sometimes very high discharges causing a lot of sediment transport in the form of sand, gravel, and silt. The amount of sediment transported can vary depending on factors like river flow, sediment supply and river management. Moreover, floods and droughts are becoming more frequent and severe due to climate change, impacting communities, infrastructure, and the environment.

The rivers serve various purposes and play a significant economic role in the region. Key uses are transportation and infrastructure, hydroelectric power, agriculture and irrigation, recreation and tourism, ecosystems and a rich biodiversity and a picturesque landscape.

A Vision for Revitalization

In the region of Gipuzkoa, nestled in the heart of the Basque Country, a transformative initiative is underway to breathe new life into its rivers. The “Plan Director de Permeabilización de Obstáculos de Gipuzkoa 2020” is a visionary project aimed at restoring the natural flow and vitality of these rivers by addressing the numerous weirs and dams that have long impeded their ecological health.

The plan’s primary objective is clear: to enhance the ecological state of Gipuzkoa’s rivers by removing or modifying obstacles that disrupt water flow and hinder the movement of

aquatic species. This ambitious endeavor spans six river basins—Bidasoa, Oiartzun, Urumea, Oria, Urola, and Deba—where a total of 228 obstacles have been identified for action. Each obstacle, whether large or small, plays a crucial role in the overall health of the river ecosystems.

Methodical Approach

The journey towards revitalization begins with a thorough diagnosis. Experts conduct comprehensive assessments of the rivers, gathering data on their physical, chemical, and biological characteristics. This information is crucial for understanding the impact of each obstacle and prioritizing actions accordingly.

Once the data is collected, the plan moves into the phase of prioritization. Obstacles are ranked based on their ecological significance and the feasibility of intervention. Factors such as the potential for improving water flow, the presence of endangered species, and the technical and financial feasibility of the intervention are carefully considered.

Environmental Impact

The anticipated environmental benefits of the plan are profound. By improving water flow and connectivity, the project aims to restore the natural functioning of river ecosystems. This will create a more hospitable environment for a wide range of aquatic species, from fish and amphibians to invertebrates.

Moreover, the plan is designed to enhance the resilience of river ecosystems to climate change. Improved connectivity will allow species to migrate to more suitable habitats as temperatures and water levels fluctuate. This adaptability is crucial for the long-term health of the rivers and their inhabitants.

FIGURE 2 *Official welcome and introduction by Jose Ignazio (top), Arantxa Uzurrunzaga (below right) and Josu Elso in the Naturklima Room Gipuzko County Council.*

The Cumbria River Restoration Programme winners of the 2022 European RiverPrize and other practitioners from the Northwest of the UK visited Albania in the autumn of 2023, for knowledge exchange with the Vjosa River team. This was an amazing worthwhile experience and in 2024 they went with some invited guests to Gipuzkoa, a mountainous province in the Basque Country to shed light on a major plan to improve river connectivity in the region. And to learn about a LIFE project improving diadromous fish population in the Calabrian region.

Bart Fokkens, Coordinator,
European Centre for River Restoration

It was an absolute pleasure to help organize this trip for my own colleagues and those working in Gipuzkoa. For many years I had heard about the great strides they had made in the dam removal field and we were really keen to learn from them about how they achieved this.

It was soon apparent during the site visits and talks that they face similar challenges to ourselves. We were keen to learn how they deal with these challenges throughout the development and delivery of their projects, to successfully achieve outcomes for both people and the environment. The trip turned out to be even greater than we had anticipated, really demonstrating the benefits of face-to-face discussion versus the more common online meetings. This was thanks to the hard work and excellent organising skills of Arantza and her fabulous colleague's, who made the trip a real thought provoking and worthwhile excursion for the whole group.

Olly Southgate, Cumbria and Lancashire River Restoration Programme Manager

FIGURE 3 *Hydro-power plant and dam Renteria and dam at the Urumea River.*

Challenges and Considerations

Of course, such an ambitious project is not without its challenges. The technical and financial feasibility of removing or modifying obstacles can be daunting. Careful planning and prioritization are essential to ensure that resources are used effectively.

Engaging stakeholders is another critical aspect of the plan. The support and cooperation of government agencies, local communities, and environmental organizations are vital for successful implementation. Strategies for stakeholder engagement and consensus-building are integral components of the plan.

Monitoring and evaluation are also emphasized. By continuously assessing the impact of the interventions, the plan ensures that actions are effective and provides valuable insights for future efforts to improve river connectivity.

A Path Forward

The "Plan Director de Permeabilización de Obstáculos de Gipuzkoa 2020" is more than just a technical document; it is a beacon of hope for the rivers of Gipuzkoa. By addressing the obstacles that have long hindered their natural flow, the plan aims to restore the vitality of these waterways, enhance their resilience to climate change, and contribute to global sustainable development goals.

As the project unfolds, it serves as a testament to the power of collective action and the importance of preserving our natural heritage. The rivers of Gipuzkoa are on a path to revitalization, and with continued dedication and collaboration, they will once again thrive as vibrant, life-sustaining ecosystems.

The LIFE KANTAURIBAI project is a significant initiative aimed at enhancing the populations of diadromous fish by restoring river connectivity in the Cantabrian region. With a substantial budget of €10.85 million, co-financed by the LIFE program, the project spans from October 2022 to September 2027. It involves a diverse consortium of 13 partners, including public authorities, municipalities, research institutions, and private entities. The project area encompasses five river basins across two countries and three regions, covering 15 Natura 2000 sites.

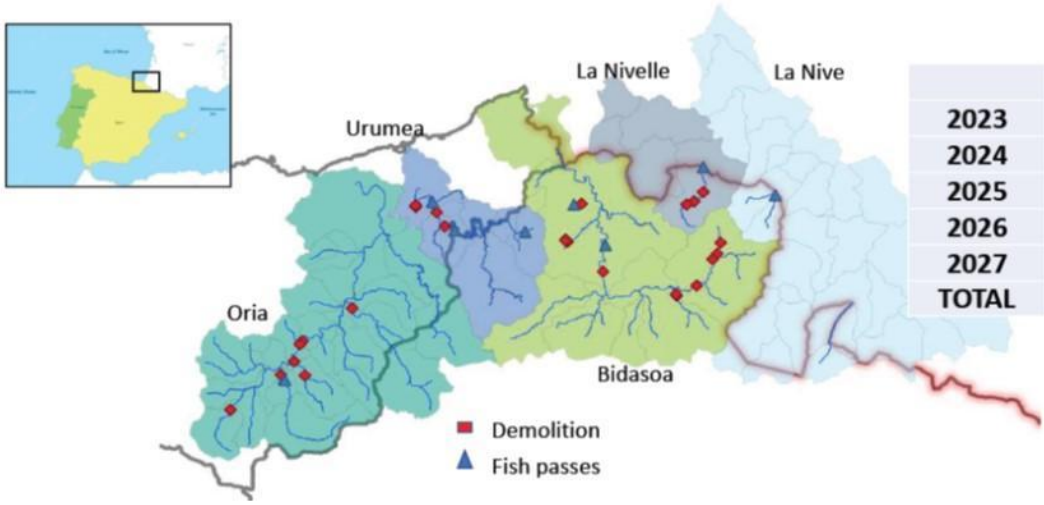
FIGURE 4 *Papelera Etxezarreta Oria River.*

FIGURE 5 *Polideportivo Antizar Oria River.*

As one of the founding partners of Olly's Cumbria River Restoration Programme here in the northwest of England, I can only echo the comments made by him. The restoration of our rivers and the mitigation of human impacts conducted over the past 150-200 years is very complex and difficult work. It requires vision, dedication and determination which Arantza and her team demonstrate in abundance. The work they have already completed in addition to their forward work programme is very impressive in scale and ambition and it was a pleasure to see this at first hand. The experience of discussing together in Gipuzkoa the various and similar challenges we face in Cumbria was invaluable. I feel that we have gained a much greater understanding; we don't work in isolation, and we have friends with whom we can share and learn and offer support.

My thanks go to Arantza and her team for their kind and generous hospitality. It was a very rewarding trip in many ways and the obvious hard work put in to make it so is very much appreciated indeed.

Pete Evoy, Director of South Cumbria Rivers Trust



	Demolitions	Fish passes
2023	6	2
2024	8	1
2025	4	1
2026	7	3
2027	0	0
TOTAL	25	7

FIGURE 6 *The LIFE Kantauribai Project area with the number of demolitions and fish passes.*

Target Species and Conservation Status

The project focuses on several diadromous fish species, including the Atlantic salmon, sea lamprey, European eel, and allis shad, all of which are currently in poor conservation status. Additionally, the project targets other species such as the freshwater pearl mussel, Iberian desman, and European mink, which are also facing conservation challenges.

Work Packages and Activities

The project is structured into several work packages (WPs), each with specific objectives and activities:

WP1: Project Management

This work package is dedicated to the overall management and coordination of the project. It ensures that all activities are carried out efficiently and effectively, adhering to the project's timeline and budget. It also involves regular communication and reporting to the LIFE program and other stakeholders.

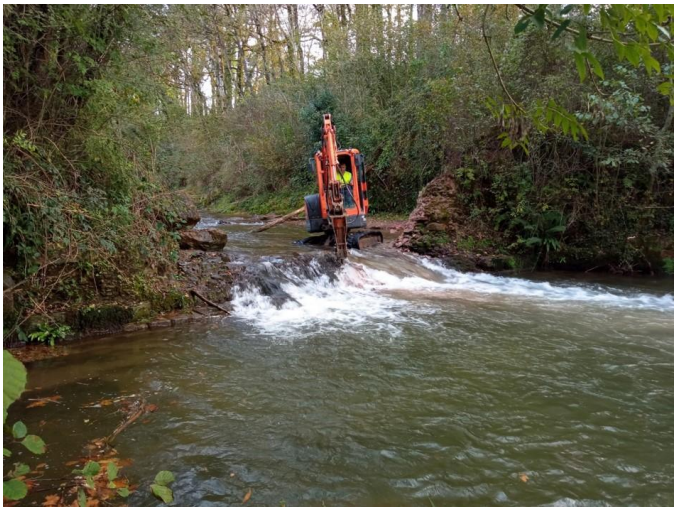


FIGURE 7 *Ikatzatea Mill dam removal 3m high.*

WP2: Restoration of the Fluvial Ecosystem

WP2 focuses on the physical restoration of river ecosystems. Key activities include the removal of dams and other obstacles, the construction of fish passes, and the restoration of riparian forests. The project plans to demolish 25 obstacles and construct 7 fish passages, aiming to restore 26 km of main rivers and 59 km of tributaries. Specific dams scheduled for demolition

include the Kisua Mill dam and Ikatzatea Mill dam. These efforts are crucial for re-establishing the fluvial continuum and improving habitats for target species.

WP3: Improvement of the Conservation Status of Diadromous Fish Species

This work package aims to enhance the conservation status of diadromous fish species through various measures. Activities are aimed at reducing fish mortality due to anthropogenic causes and improving the management of diadromous fish, in rivers shared by y three regions (Navarra, Gipuzkoa and Nouvelle-Aquitaine) in two countries (Spain and France). The project also involves monitoring fish populations and assessing the effectiveness of the restoration efforts.

FIGURE 8 *Foundry dam (Ugarana).*

WP4: Improvement of the Conservation Status of the Freshwater Pearl Mussel

WP4 is dedicated to the conservation of the freshwater pearl mussel, a species that is highly sensitive to environmental changes. The project aims to improve water quality and habitat conditions to support the survival and reproduction of this species. Activities include the the beginning of a captive breeding plan to strengthen wild populations of the mussels.

WP5: Improvement of the Conservation Status of the Iberian Desman and European Mink, and Control of Invasive Alien Species

This work package focuses on the conservation of the Iberian desman and European mink, both of which are facing significant threats. The project aims to improve their habitats and reduce mortality and the impact of invasive alien species. Activities include habitat restoration, the creation of refuges, and the implementation of measures to control invasive species.

FIGURE 9 *Arantza Fish Farm dam (Latsa) 8.5 meters high.*

WP6: Monitoring and Evaluation

WP6 involves the continuous monitoring and evaluation of the project's activities and outcomes. This work package ensures that the project is on track to achieve its objectives and allows for adjustments to be made if necessary. Monitoring activities include the collection of data on target species populations and habitat conditions.

WP7: Communication, Dissemination, Sustainability, Replication, and Exploitation of Results

The final work package focuses on the communication and dissemination of the project's results. It aims to raise awareness about the importance of river restoration and the conservation of diadromous fish species. Activities include the production of informational materials, the organization of events, and the engagement of stakeholders. The project also aims to

ensure the sustainability of its results and promote the replication of successful practices in other regions.

Fish Mortality in Hydropower Plants

A significant aspect of the project is addressing fish mortality in hydropower plants (HPPs). The project involves analyzing fish mortality rates, implementing solutions, and installing automated control and monitoring systems. The goal is to reduce fish mortality during downstream migration through turbines and other HPP structures.

Expected Outcomes

The combined implementation of both projects aims to enhance the conservation status of target species by improving river connectivity and habitat quality. It also seeks to develop and implement solutions to reduce fish mortality in HPPs, with plans for replication in other regions.

And the goal is to create a sustainable and replicable model for river restoration and species conservation.

FIGURE 10 *Gipuzkoa and Cantabria hosts with UK and ECRR guests.*

Breaking Barriers: How the Open Rivers Programme is Restoring Europe's Rivers

Author

Jack Foxall — Executive Director, Open Rivers programme, jack.foxall@openrivers.eu

The fundamental aim of ORP is to restore biodiversity in European rivers. The programme seeks to maximise the potential ecological impact it can achieve by removing as many small barriers (usually 1–5 metres in height) as possible. Around two thirds of all barriers in Europe are small and targeting these structures arguably represents the most cost-effective means of enabling free-flowing rivers. ORP also carefully selects projects that will achieve high ecological impacts, aiming to restore at least 10km of river for each barrier removed, as well as projects that are highly viable and can be delivered over short timescales. This usually means targeting obsolete barriers that no longer serve a purpose (there are at least 150,000 in Europe) and where removal is supported by local authorities and communities.

The European Open Rivers Programme

The Open Rivers Programme (ORP) is a charitable foundation based in the Netherlands which offers grants to support projects in Greater Europe that lead to the removal of small barriers (such as weirs, dams and culverts) and restore river flow and biodiversity. This article discusses why ORP was set up, how it operates, and what is being achieved. It also shares insights into what the ORP believes is needed to ensure more barrier removals and thus more free-flowing rivers in Europe.

Why was ORP created?

ORP is funded by Arcadia, a philanthropic organisation based in the UK that works to protect nature, preserve cultural heritage and promote open access to knowledge. During 2019, Arcadia became interested in barrier removal after learning that organisations in the United States are increasingly employing the approach as a cost-effective and fast means of restoring rivers. This led to a research assignment that revealed how bad the problem was in Europe – the continent is the most fragmented on the planet with over one million barriers that are collectively causing enormous damage to the ecological functioning of rivers. At the same time, it was revealed that barrier removal can swiftly revive river flow and restore ecosystems, but only a few organisations were actively promoting and funding it at the European level.

Recognising the scale of the issue, the funding gap, and the unique opportunity for impact, Arcadia enabled the creation of the Open Rivers Programme on 1st October 2021, with a grant of €42.5 million. A new and independent organisation was formed – Sichting European Open Rivers Programme – to operate the programme. The original period of the grant from Arcadia was 2021–27, but it was later extended to 2029.

Grant types

ORP's current portfolio of grants reflect the fact that barrier removal is not being widely implemented in Europe. In some countries, it is not even clear where the barriers are located, who the owners are, which institution can authorise the removal, or which ones should be removed. In addition, most projects are not 'demolition ready' and require support during preparatory phases. As a result, the following grant types are offered:

A – Programme supported dam removals

Within this category, the programme offers four grant types:

- A1 - support to help practitioners **identify** barriers and **shortlist** the most viable ones to be removed. These grants are only available in countries with poorly developed inventories and low capacity, resources, and attention to barrier removal. The outcome must be one or more small barriers selected for removal.
- A2 - **preparing** for the demolition of one or more barriers and supporting activities such as producing technical designs, carrying out essential feasibility studies, and securing permits. The outcome must be that one or more barriers are ready to be removed.
- A3 - **demolition** – new project that has not previously received an identification (A1) or preparatory (A2) grant.
- A4 - **demolition** – project had previously received support for the same barrier/s via an A1 or A2 project.

B – Enabling others to remove dams

To support preparatory work when funding for the barrier removal (demolition) could be sourced from an alternative source.

C – Enabling the dam removal movement

To support activities to ensure barrier removal is better understood and more widely implemented such as knowledge development, policy advocacy and communications.

In 2024, ORP took a decision, in collaboration with its donor, to remove grant category C. The reason was not because the programme believed that these types of interventions were no longer needed, more so that it was felt that ORP should focus on maximising impact and directly supporting the removal of barriers. It was recognised that there is still a need to identify and shortlist barriers, as well as to prepare projects if we wish to achieve sufficient barrier removals. For this reason, all other grant types within categories A and B were retained and continue to be offered to new applicants.

FIGURE 1 *Croatia – Bijela Rijeka barrier removal. Credits: Petra Boic Petrac / WWF Adria*

How we select projects

ORP currently invites new applications three times each year via an online portal. Guidelines and assessment criteria are shared on ORP's website and the programme also runs a 'Q&A'

webinar for interested parties in each application round.

After an application is received, the programme team checks all applications to ensure they are complete and are eligible for support. They then undergo a detailed review by the programme's Grant Selection Panel (GSP). This is composed of seven independent experts who are professionals in fields relating to barrier removal such as engineers, ecologists, restoration specialists, geomorphologists, policy, communications and legal experts.

The GSP follows a detailed assessment process to score and comment on each of the applicant's answers, according to how well they meet ORP's criteria. The scores are then combined and averaged offering a ranking of applications. All applications are discussed in a meeting of the GSP and applications are either approved or declined for support.

Barrier removal projects that score highest are usually those that **a)** demonstrate high ecological impact against the cost, ideally restoring at least 10km of river, **b)** can be completed within a year and **c)** are low risk / highly viable. Identification and preparatory projects score highest for the same reasons but should also give high certainty that the barrier/s removal will eventually result from the interventions.

FIGURE 2 *Latvia – Beja barrier before removal. Credits: Magda Jentgena / Pasaules Dabas Fund.*

FIGURE 3 *Latvia – Beja barrier after removal. Credits: Magda Jentgena / Pasaules Dabas Fund.*

Our grantees

The programme originally set out to only allow NGOs to apply for a grant, but we received a lower-than-expected demand for grants during 2021/22. For this reason, eligibility was expanded from 2023 to public bodies that have water management responsibilities, although this was restricted to barrier removal grants only and the entity is required to contribute at least 50% of the costs. As at November 2024, most of our grantees are general focus environmental NGOs that do not focus solely on rivers. Not surprisingly, most (43%) of supported projects were in north-west Europe, followed by south-east (26%), south-west (19%) and north-east (12%).

Going forward, we hope to see many more public authorities applying for our grants but also new NGOs too. Whilst the reasons for lower than expected demand are complex, we still see a lack of organisations that are suitably skilled and able to implement barrier removal projects. Whilst we do not allow private organisations to apply directly for funding, they are still welcome to be a project partner with an eligible co-ordinating organisation.

What have we achieved to date?

In just over three years, ORP has supported 127 projects in 31 countries and regranted €9.8 m. ORP's support has also leveraged €11.9 m in co-funding. When complete, these projects will have removed 119 small barriers and restored 1,113 km of river. They will also have prepared projects for the removal of a further 78 small barriers and the restoration of an additional 690 km of river, using a follow-on grant from the programme.

The programme is delighted to already be supporting projects in 60% of the countries of Greater Europe. Of particular interest, grants were awarded to support the first ever barrier removal projects in Croatia, Latvia and Slovenia. A project in Ukraine in the Carpathian Biosphere Reserve will remove three barriers and open up 140 km of river. Another in Finland has supported the completion of a project that began 25 years ago, freeing the entire Hiitolanjoki River, restoring 53 km from Lake Ladoga to its upper tributaries.

FIGURE 4 *Slovenia – Kopitarna barrier removal. Credits: WWF Adria.*

What have we learnt to date?

There are several lessons that the programme has learnt over the past three years. The first is that despite the large number of obsolete barriers in Europe, there are few 'oven ready' projects out there. At the same time, most projects need support for preparatory phases before a barrier can be removed. This means that even the fastest barrier removals will take 1–3 years to achieve. It also means that without ORP support to preparatory phases, we would not be able to reach the scale of barrier removal that we desire.

Secondly, the number of practitioners that are able to remove barriers is limited. We estimate that only several hundred environmental NGOs currently have, or are able to draw upon, the expertise required to prepare and implement a barrier removal project.

Thirdly, we have seen that practitioners can rarely remove all the barriers in a catchment. The reasons for this are complex but some of the common ones are that the barrier is still in use, the owner does not wish to let it go, there is community or public opposition, the removal would be expensive against the ecological gains, or it could pose a risk to nearby infrastructure.

Finally, there is much misinformation about the impacts of barrier removal and often scepticism about its ecological, economic and social benefits. There is much to do still to promote barrier removal not just as an effective means of achieving river restoration but in helping to provide important ecosystem services and in making rivers more resilient to climate change and flooding.

The lessons outlined above confirms that barrier removal remains in an early and underdeveloped phase in Europe. ORP has received fewer applications to date than expected and this has impacted our planned period of operation. In spring 2024, we took the decision to extend the programme's current period of operation to 2029. This is the time period that we currently see as realistic to meet our targets of removing **500 barriers** and restoring **5,000 km** of river. The good news is that we have seen a gradual year on year increase in applications to date and we expect further growth in future years.

FIGURE 5 *Demolition of Bogdan river dam, Ukraine. Credits: Danube-Carpathian Programme.*

FIGURE 6 *Bogdan river dam (Ukraine) after demolition. Credits: Danube-Carpathian Programme.*

Looking forward

Our strategy to date has been to attract new applications and build a strong pipeline of projects (supporting identification, prioritisation and preparatory phases) to ensure we can also support a high number of barrier removals. However, true success is not so much about the number of projects supported by ORP but on the progress being made by others – public sector, barrier owners, other practitioners, - to identify, prepare and implement new projects. Success is also dependent on more supportive policies being in place and for these policies to be implemented.

It is our hope that the Nature Restoration Law that came into effect this year will drive greater interest and attention by others to remove barriers. ORP will play an active role in helping to facilitate this process by engaging with others to create interest and momentum for barrier removal as well as more supportive conditions. It is our overall goal over the next three years to make a gradual transition away from supporting identification, prioritisation and preparatory work. We very much hope that others will do more to implement these tasks leaving ORP to focus more on supporting demolitions.

FIGURE 7 *Finland Ritaksoki dam during removal. Credits: Mikko Nikkinen.*

FIGURE 8 *Finland Ritaksoki dam after removal. Credits: Mikko Nikkinen.*

Restoration of Lower Dnipro Ecosystems: Prospects and Challenges

Authors

Oleksiy Vasyliuk — Ukraine Nature Conservation Group (UNCG)

Eugene Simonov — Ukraine War Environmental Consequences Work Group

Introduction

Dnipro river, straddling three countries (Belarus, Russia, Ukraine), is one of the ten largest river ecosystems of Europe, which has been severely modified during the XX century by hydropower dams and Soviet industrial development. The on-going war adds negative impacts, increasing pollution from munitions and damaged civilian facilities, while destruction of dams leads to catastrophic changes in riverine landscapes. A year and a half have passed since Russian troops blasted the dam of Kakhovka Hydropower Plant, draining Kakhovka Reservoir and unleashing a catastrophic flood on the Lower Dnipro. We are trying to explore what opportunities exist for ecological revival and sustainable development along the Lower Dnipro after the war. Our initial analysis shows that a major opportunity for river restoration may be one of the most sustainable development options.

FIGURE 1 *Botanist Dr. Anna Kuzemko on the bottom of Kakhovka Reservoir in 2023. Credits: Lubov Barsukevich, Lviv Ivan Franko National University.*

The biggest environmental shock of the war

After the June 2023 destruction of Kakhovka Dam, in February 2024 the European Parliament passed a law making large-scale and intentional environmental damage "comparable to ecocide" a crime punishable by up to ten years in prison. Throughout 2024, there are growing calls for ecocide to be recognized as an international crime. The Kakhovka catastrophe became the most powerful symbol of environmental destruction caused by the war.

Immediately after the blast, it was important to assess the scale and consequences of the environmental changes associated with the hydropower plant's destruction. UWEC experts identified several areas with very different impacts.

The flooding zone begins just downstream from the dam and extends by 600 square kilometres to the Dnipro-Bug Estuary. Here the main negative impact was a huge anthropogenic flood, which took more than 100 human lives, damaged dozens of settlements as well as many biodiversity-rich natural habitats. Along the lower left bank there is also a zone with raised groundwater levels, which affected local ecosystems.

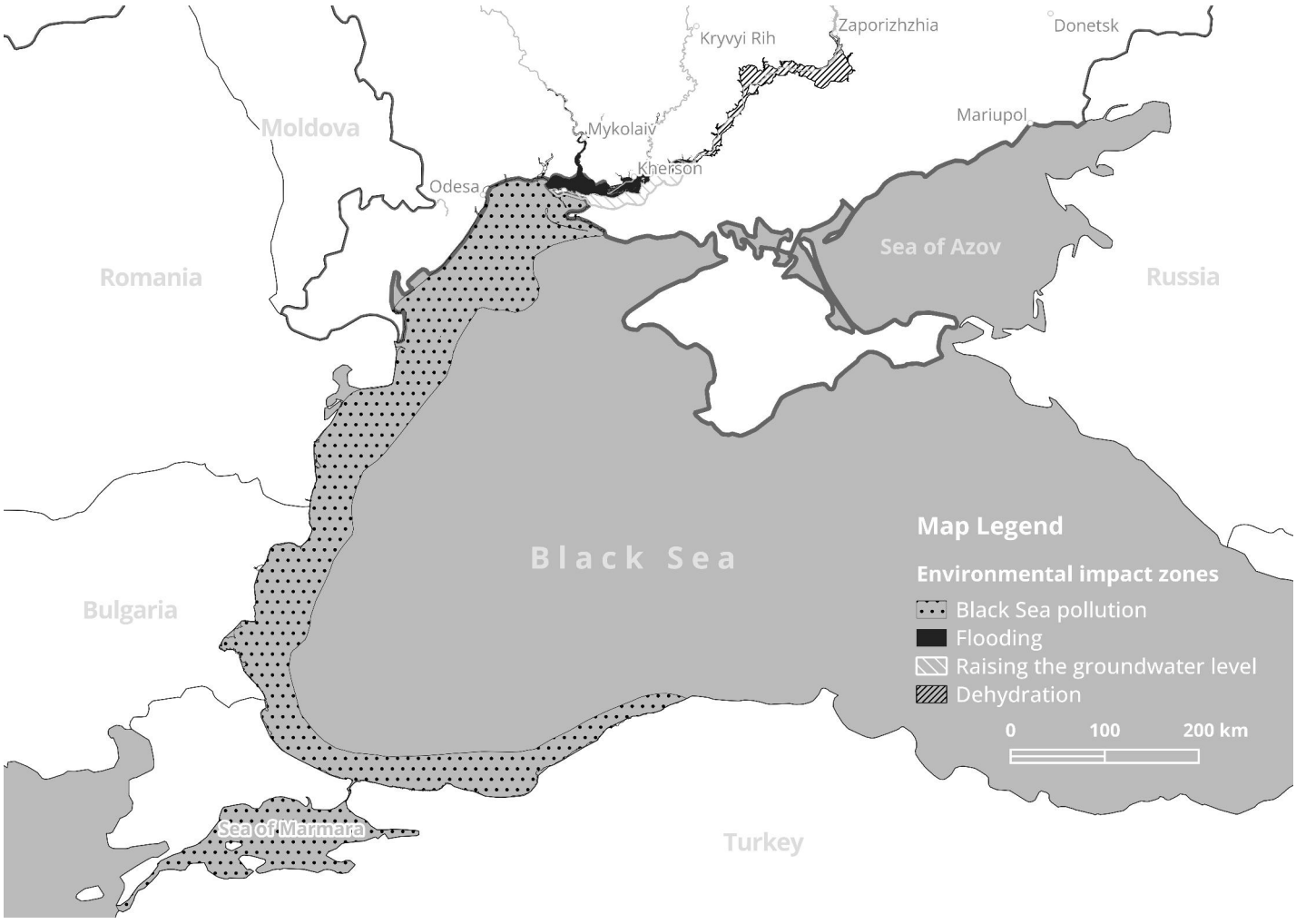


FIGURE 2 *Map: Zones of impacts from the Kakhovka dam blast. UNCG 2024*

The dehydration zone is upstream of the former dam and spans the entire area formerly covered by Kakhovka Reservoir, the emptying of which irrevocably destroyed the artificial ecosystem of the reservoir itself, along with millions of its natives.

The zone of sea pollution is an extensive expanse of coastal waters in the western part of the Black Sea, which experienced great influx of fresh water and suspended sediments containing often toxic substances.

More than 50 protected areas along the Lower Dnipro ended up either in an active combat zone or under Russian occupation, including Lower Dnipro National Park, Black Sea Biosphere Reserve, Biloberezhzhia Sviatoslava National Park, and Velykyi Luh National Park. Ecosystems and management facilities of practically all these protected areas have been severely affected by consequences of the Kakhovka dam blasting. Even after liberation, such areas still face problems such as active shelling and built fortifications, particularly those that found themselves on the frontline. Parks and reserves lost supplies, personnel, and equipment during their occupation, and that, combined with land mines and constant shelling, significantly impedes fulfilling of their conservation mission.

FIGURE 3 *Dead Danube newts, washed into the sea from the Lower Dnipro by floodwaters from the reservoir. Source: Ministry of Environmental Protection and Natural Resources of Ukraine*

As most of the affected area is not accessible due to proximity to war-zone, the estimates of damage have been incomplete, but what we know to date confirms enormous damage to local communities, conservation institutions, ecosystems and populations of biological species.

Rapid self-restoration of riverine ecosystems

Immediately after the dam's destruction, it became clear that the land newly freed from the artificial reservoir has enormous potential for restoration of natural floodplain ecosystems.

Satellite images revealed that the newly exposed territory retained the features of riparian ecosystems lost in the Soviet era when the reservoir filled during construction of the Dnipro cascade of dams. Environmentalists have been overjoyed to see the rapid reappearance of Velykyi Luh ("Great Meadow"), a wooded, swampy floodplain meadowland and historical landscape tracing to the Zaporizhzhia Sich – the ancient Ukrainian state entity.

Prior to reservoir filling, humans and wildlife prospered in the wide Dnipro floodplain thanks to the region's undisturbed ecological processes. This zone was home to hundreds of bird species, while multitudes of fish came here from the Black Sea to spawn. The river regularly flooded, revitalizing its branches, channels, and lakes, bringing fertile silt to thousands of square kilometres of land, and giving rhythm to the life cycles of all the area's animal and plant species. This was all destroyed when the gigantic shallow reservoir was filled; no less an act of ecocide than the catastrophic sabotage of the dam in 2023.

FIGURE 4 *Satellite image showing the exposed reservoir bed. 20 June 2023. Source: Sentinel Scientific Data Hub*

The ecosystems began to recover just a few weeks after the reservoir emptied. Satellite photos of the exposed bed indicate that the earlier network of channels, lakes and islands remained. Expeditions in 2023 and 2024 to different sectors of the former Kakhovka reservoir showed that native vegetation began to actively recover in some parts of the exposed bed barely a month after the draining of the reservoir. By the end of summer 2024 the young willow-poplar forest, 3-4 meters high, is covering at least 40% of reservoir bottom that was once predicted to become a desert. Forests are dominated by willow *Salix fragilis (EUNIS G1.11 in EU Habitat Classification)*. According to Dr. Anna Kuzemko, this type of floodplain forest was typical in these areas before the reservoir was filled.

FIGURE 5 *Willow forest recovery in fall 2023. Credits: Ivan Moysiyenko, UNCG.*

The abundant spring floods of 2024 demonstrated the fundamental importance of periodic flooding in order for these ecosystems to maintain their biological productivity and diversity.

The return of migratory sturgeons to the upper part of former reservoir was documented in May 2023 by government fishing inspectorate, who arrested poachers near Zaporizhzhia City and examined their catch.

FIGURE 6 *Danube sturgeons caught by poachers upstream of former Kakhovka dam in Zaporizhzhia in May 2024. Credits: Fisheries Inspectorate. Source: akzent.zp.ua.*

What can be done now for ecosystem restoration?

Except for bays at the mouths of the river's right-bank tributaries and the surroundings of the city of Zaporizhzhia, the former Kakhovka Reservoir and low-lying Dnipro valley are under fire from Russian artillery, drones and snipers, limiting civilian activity and complicating monitoring of ecosystem dynamics.

For now, monitoring and recovery forecasting for vegetation on the site of the former reservoir rely mainly on satellite imagery analysis and surveying expeditions in areas formerly under water in Kamenska Sich National Park and Khortytsia Historical and Cultural Reserve.

FIGURE 7 *Map: At present the entire Lower Dnipro ecosystem lies on the frontline and within the warzone, impeding monitoring and restoration activities. Source: DeepState*

Expeditions in 2024 have shown that it is not only floodplain vegetation that is recovering, but also steppe vegetation, where plants grow on the exposed slopes of the banks of the former reservoir. At the same time, the restoration of a few typical plant communities, for example, floodplain oak forests, may be hindered by a lack of seed sources.

Ukrainian NGOs are working with international donors to develop effective assistance programs for protected areas, predominantly in territories liberated from occupation. Maintaining and developing the capacity of conservation institutions is a critical aspect of efforts to restore ecosystems and create conditions for long-term conservation management in key biodiversity areas.

As the frontline retreats from the left bank of the Dnipro; national parks will then be able to serve as a base for comprehensive biodiversity monitoring. That work includes studying changes in the species composition of birds and mammals, as well as monitoring fish migration from the lower Dnipro to the Zaporizhzhia region. Before the hydropower plant was built, the Dnipro's ichthyofauna included 70 species of fish, many of which made significant migrations.

FIGURE 8 *Russian fortifications in Kamenska Sich National Park, 2022. The feathergrass used to camouflage it is a protected species. Ivan Moysiyenko, UNCG.*

The restoration of the Dnipro floodplain complex depends on the pulsing flow of the river, a process that dams further upstream disrupt. Environmental flow releases from upstream reservoirs must be incorporated into operations of the remaining hydropower cascade to maintain Lower Dnipro floodplain ecosystems. At present this is the primary focus of discussions between, on the one hand, environmental organizations and scientists, and, on the other, water departments, power engineers, and international banks financing modernization and restoration of the hydropower plants.

Further ecosystem recovery threatened by a new dam

On 18 July 2023, the Cabinet of Ministers of Ukraine hastily issued a resolution proclaiming the intention to rebuild the Kakhovka dam. The resolution is not at all founded on comparisons with any alternative options for restoring the country's economy and environmental well-being in the context of the ongoing war. Incidentally, the Russian occupation authorities have also trumpeted their own plans to rebuild the Kakhovka hydropower plant.

The original 1950s facility with a giant shallow reservoir spanning 2,150 square kilometres had several purposes: generating electricity, increasing the depth of shipping routes, supplying water to cities, villages, and irrigating fields. Such management system itself, based on wasteful use of water, is hopelessly outdated, not least when climate change is considered. Almost two cubic kilometres of water were lost from the reservoir each year due to evaporation. Up to a half of the Dnipro's flow was used for irrigation, but most of the water evaporated from the canals without ever reaching crops. This, in turn, was causing soil salinizat-

ion and degradation in steppe grasslands previously converted for agricultural use.

After the blast many experts called for more efficient use of land and water resources when redesigning Kakhovka reservoir. One plan proposes to build a 60-kilometer-long dyke to divide deep and shallow parts of the reservoir to restore the "steppe meadow" without actual floodplain restoration. Others bluntly envision a similar dyke to allow use of the shallow area for fish-farming or agriculture.

In September 2023 the UNCG published a detailed position on the reasons why ecosystem restoration is more advantageous than rebuilding the dam.

Rebuilding a 20th-century power plant is not only expensive, but also outdated compared to modern agricultural and energy technologies, not to mention the imperatives of climate adaptation. For example, a maximum of 25 square kilometres of solar power arrays are required to generate comparable volumes of energy relative to the rebuilt hydropower plant's production, i.e. an area 100 times smaller than land occupied by the reservoir. Unlike hydropower plants, solar generation can be dispersed, making generation facilities radically less vulnerable to enemy shelling.

The restoration of the pre-catastrophe status quo reservoir will become possible only in 10-15 years, after the end of the war, when the majority of local communities that once depended on the supply of water and electricity from the Kakhovka hydropower plant will already be supplied with both water and energy from alternative sources. Local communities cannot wait decades for "the conditions to be ripe" to recreate a questionable past; Ukraine's green recovery must be based on modern realities and new opportunities.

Recruiting support for green recovery of the Lower Dnipro ecosystem

The good news is that over the past year there have been increasing numbers of stakeholders demanding that alternatives to rebuilding the Kakhovka Dam and hydropower plant be considered. And those voices were heard by uppermost bureaucracies. The Environmental Compact for Ukraine, proposed on 31 January 2024 by the High-Level Working Group on the Environmental Consequences of War, cautiously states: "*The government previously announced its intentions to restore the dam. At the same time, some interesting compromise solutions were developed which are deserving of attention ... It is recommended to involve independent experts for careful analysis of the options and the environmental consequences associated with them.*" As this Group is coordinated by the Ukraine President's office, the statement shows significant changes in official approach to the issue.

Environmental NGOs continue to develop arguments supporting the ecosystem restoration option. In order to effectively promote plans to restore Lower Dnipro ecosystems, there is also a need to identify allies to implement the most beneficial economic restoration scenarios for livelihoods of local communities. Communities were once adapted to the old reservoir and are unlikely to cease their support to its rebuilding, unless provided with resources and best technical advice for developing superior alternative lifestyles. This strategy is impossible to employ without maintaining and developing democratic decision-making procedures, especially public discussions of the social and environmental consequences of economic projects, which have been constrained by martial law and other war-related policies.

From the European perspective, the practical achievement of the river restoration objective will be facilitated by the EU Nature Restoration Law, which came into effect in August 2024 and prescribes restoring 25000 kilometres of European rivers previously fragmented by dams. Wider EU policy encouraging nature-friendly agriculture rules out support for restoration of water-thirsty industrial irrigation and provides incentives for biodiversity-friendly farming practices. In the context of European integration, the use of new EU legislation and programs for the restoration of natural ecosystems can support efforts in planning and legal support for the restoration of the Lower Dnipro ecosystem, from the City of Zaporizhzhia to the Black Sea. In the context of Ukraine's accession to the EU, the success in restoring the great river's ecosystems largely depends on position of leading European environmental organizations and the European Commission's offices participating in this process.

Restoring natural freshwater ecosystems along a 250-kilometer stretch of the Lower Dnipro could be the largest project of its kind in Europe and has the potential to become Ukraine's decisive contribution to meeting EU commitments to restore rivers to their natural state by 2030.

FIGURE 9 *Green Sea in place of Kakhovka Reservoir, 2024. Credits: Vincent Mundy.*

Colophon

Contact

✉ secretariat@ecrr.org
P.O. Box 2180
3800 CD Amersfoort
The Netherlands
☏ +31651216467

Target audience

River restoration practitioners in greater Europe

Publisher

ECRR Board represented by
Bart Fokkens

Editors

Bart Fokkens, ECRR

Articles

If you want to share your river restoration experience, project or study through us with others, please write an article about it. An article should preferably have about 1000 words and include about 4 appealing and informative pictures with captions. You can send the draft article to secretariat@ecrr.org

Subscribing

You can become a free subscriber of the ECRR Technical Newsletter (2-3 × per year) and the ECRR eNews (5 × per year) by subscribing here, and you can always unsubscribe!

The ECRR association member and partner organisations

I.S. Rivers – Integrative Sciences – Recherches et Actions
SYKE – Finnish Environment Institute
OFB – Office Français de la Biodiversité
Norwegian Environment Agency
Blue Rivers Foundation
CIREF – Centro Ibérico de Restauración Fluvial
CIRF – Centro Italiano per la Riqualificazione Fluviale
Global Water Partnership Central and Eastern Europe
Warsaw University of Life Sciences – SGGW
Swedish Agency for Marine and Water Management
Wetlands International
International Network of Basin Organizations
stowa – Foundation for Applied Water Research
IBMiM
Suomen Vesistösäätiö
The River Restoration Centre – Working to restore & enhance our rivers

ECRR – European Centre for River Restoration
The network for best practices of river restoration in Greater Europe

Encourages and supports ecological river restoration
Connecting people and organisations
Supporting development of best practices of river restoration